ABSTRACT OF THE DISCLOSURE

A1

A method of determination of a property of an optical device under test includes using a first initial coherent light beam, changing a first initial property of the first initial light beam, coupling the first initial light beam to the device under test, detecting a first signal of the first initial light beam received from the device under test, and correcting any a non-linearity in the first signal by interpolating the first signal on a linear scale.

In The Claims

Please amend the claims as follows:

A2

1. (Amended) A method of determination of a property of an optical device under test, comprising:

   using a first initial coherent light beam,

   changing a first initial property of the first initial light beam,

   coupling the first initial light beam to the device under test,

   detecting a first signal of the first initial light beam received from the device under test, and

   correcting a non-linearity in the first signal caused by a non-linearity in the change of the first initial property by interpolating the first signal on a linear scale.

2. (Amended) The method of claim 1, further comprising:

   using a second initial coherent light beam,

   changing a second initial property of the second initial light beam,

   detecting a second signal of the second initial light beam without coupling it to the device under test, to discover a non-linearity in the second signal

caused by a non-linearity in the change of the second initial property, and

using the discovered non-linearity of the detected second signal to interpolate the first signal.

3. (Amended) The method of claim 1, further comprising:

producing a coherent light beam, and

splitting the coherent light beam into a first initial light beam and a second initial light beam.

4. (Amended) The method of claim 1, further comprising detecting the first resulting property simultaneously with the second resulting property.

5. (Amended) The method of claim 1, further comprising changing the first initial property simultaneously with the second initial property.

6. (Amended) The method of claim 1, wherein the first initial property and the second initial property are the same initial property.

7. (Amended) The method of claim 1, wherein the initial property is the frequency of the coherent light beam.

8. (Amended) The method of claim 1, further comprising:

transforming the first signal in a number of phase signals over a linear scale of a number of points of time,

transforming the second signal in a number of frequency signals over the same linear scale of points of time to discover a non-linearity in the second signal caused by a non-linearity in the change of the initial property, the initial property being the frequency of the coherent light,

assigning the transformed first signal to the transformed second signal, and

interpolating the assigned transformed first signal on a linear scale of

frequencies.

9. (Amended) The method of claim 8, further comprising creating the linear scale of frequencies $f_{lin}(n)$ according to the formula

$$f_{lin}(n) = (f_{min} - f_{max}) \times (n/N), \text{ n Element } 1,\ldots, N,$$

N being the number of points of time.

10. (Amended) The method of claim 1, further comprising:

A2 cont.

~~splitting the first initial light beam into a first light beam and a second light~~ beam,

coupling the first light beam to the optical device under test,

letting the second light beam travel a different path as the first light beam,

superimposing the first and the second light beam to produce interference between the first light beam and the second light beam in a resulting first superimposed light beam,

detecting as a first signal the power of the first superimposed light beam as a function of time when tuning the frequency of the coherent light beam from a minimum to a maximum of a given frequency range in a given time interval,

splitting the second initial light beam in a third light beam and a fourth light beam,

superimposing the third light beam and the fourth light beam after each light beam has traveled a different path, to produce interference between the third and the fourth light beam in a resulting second superimposed light beam,

detecting as a second signal the power of the resulting second superimposed light beam as a function of time when tuning the frequency

of the coherent light beam from a maximum to a minimum of a given frequency range in a given time interval,

using the detected second signal for deriving a non-linearity information about a non-linearity in a tuning gradient of the frequency when tuning the frequency of the coherent light beam from the maximum to the minimum of the given frequency range, and

using the non-linearity information for correcting effects on the first signal caused by the non-linearity to get a corrected first signal.

A2 cont.

11. (Amended) The method of claim 1, further comprising deriving the non-linearity information by:

transforming the second signal to get a Fourier transformed second signal,

eliminating the negative parts of the Fourier transformed second signal to get a non-negative Fourier transformed second signal,

retransforming the non-negative Fourier transformed second signal to get an analytic signal of the second signal,

determining the phase of the analytic signal to get as a second phase signal the phase as a function of time of the second signal, and

using the second phase signal for determining as the non-linearity information the frequency as a function of time of the second signal.

12. (Amended) The method of claim 1, further comprising deriving a first phase signal by:

transforming the first signal to get a Fourier transformed first signal,

eliminating the negative parts of the Fourier transformed first signal to get a non-negative Fourier transformed first signal,

retransforming the non-negative Fourier transformed first signal to get an analytic signal of the first signal, and

determining the phase of the analytic signal to get as a first phase signal as a function of time of the first signal.

13. (Amended) The method of claim 1, further comprising correcting the effects on the first signal caused by the non-linearity by using the non-linearity information to interpolate the first phase signal of the first signal on a linear scale of frequencies to get a corrected first phase signal.

A2 cont.

14. (Amended) The method of claim 1, further comprising determining the frequency f(n) of the second signal as a function of n discrete points of time, n= 1, ..., N, on the basis of the second phase signal to determine the non-linearity information by:

determining the second phase signal $\phi(n)$ at the n points of time,

determining the maximum ϕ_{max} of the second phase signal, and

using a predetermined maximum frequency f_{max} of the frequency range, a predetermined average tuning velocity during tuning the frequency and the maximum ϕ_{max} of the second phase signal to determine for each of the n points of time the frequency f(n) according to the formula: $f(n)=[(f_{max}-f_{min})/\phi_{max}]\phi(n)$.

15. (Amended) The method of claim 1, further comprising getting the linear scale $f_{lin}(n)$ of frequencies by:

using the predetermined maximum frequency f_{max} of the frequency range and the predetermined minimum frequency f_{min} of the frequency range to determine the linear scale $f_{lin}(n)$ of frequencies according to the formula: $f_{lin}(n)=[(f_{max}-f_{min})/(N-1)]n$, and

sorting the absolute values of f(n) monotonically.

16. (Amended) The method of claim 1, further comprising using f(n) for interpolating the first phase signal of the first signal on the linear scale of frequencies $f_{lin}(n)$.

17. (Amended) The method of claim 1, further comprising deriving transmissive and/or reflective properties of the optical device under test from the compensated first signal.

18. (Amended) The method of claim 1, further comprising at least one of the following:

deriving a group delay of the optical device under test as a function of frequency from the corrected first signal, and

deriving the chromatic dispersion coefficient of the optical device under test as a function of frequency from the corrected first signal.

19. (Amended) The method of claim 1, further comprising deriving a group delay of the optical device under test by differentiating the corrected first phase signal with respect to the frequency.

20. (Amended) The method of claim 1, further comprising ignoring at the begin of the tuning a predetermined amount of values of the corrected first phase signal to eliminate teething troubles out of the corrected first signal.

21. (Amended) The method of claim 1, further comprising:

approximating the group delay with polynoms of at least second order to get an approximated group delay, and

subtracting the approximated group delay from the group delay to get a non-linear part of the group delay.

22. (Amended) The method of claim 1, further comprising using the non-linear part of the group delay to determine the mean signal power of a deviation from a linear group delay of the device under test.

23. (Amended) The method of claim 1, further comprising using the square coefficient of the polynomial to determine the mean gradient of the group delay.

24. (Amended) The method of claim 1, further comprising making the first signal oscillating about a zero line by:

determining the points of mean value of the first signal,

interpolating a curve through these points, and

subtracting the values of the curve from the first signal to get a corrected first signal oscillating about the zero line.

A2 cont.

25. (Amended) The method of claim 1, further comprising determining the points of mean value by extracting all points with a maximum gradient.

26. (Amended) The method of claim 1, further comprising making the first signal oscillating about a zero line by determining the points of mean value of the first signal by:

determining the maximum and the minimum of the first signal in a predetermined first range of time smaller than the total range of time,

determining a mean value between the maximum and the minimum,

determining the maximum and the minimum of the first signal in a predetermined next range of time adjacent the already examined range of time,

determining a mean value between the maximum and the minimum, and

repeating the last two steps until the complete time interval is covered.

27. (Amended) The method of claim 1, further comprising choosing the predetermined range of time by:

determining the average period of the oscillations of the first signal, and

choosing the size of the range so that more than two average periods fit in the chosen range of time.

28. (Amended) The method of claim 1, further comprising determining the points of mean value by:

determining the maximum of the Fourier transformed signal of the first signal,

using the maximum to determine a size of a high-pass filter, and

filtering the Fourier transformed first signal with the high-pass filter.

29. (Amended) A method of determination of a property of an optical device under test, comprising:

detecting a change of a signal with time, being the basis for deriving the property, and

filtering the detected signal by:

transforming the detected signal to get a Fourier transformed signal,

filtering the Fourier transformed signal with a filter to get a filtered Fourier transformed signal,

retransforming the filtered Fourier transformed signal to get a filtered signal, and

deriving the property on the basis of the filtered signal.

30. (Amended) The method of claim 29, further comprising correcting the detected signal for a non-linearity to get a corrected first signal by:

using a first initial coherent light beam,

changing a first initial property of the first initial light beam,

coupling the first initial light beam to the device under test,

detecting a first signal of the first initial light beam received from the device under test, and

correcting a non-linearity in the first signal caused by a non-linearity in the change of the first initial property by interpolating the first signal on a linear scale.

31. (Amended) The method of claim 12, further comprising:

A2 cont.

using the corrected first signal to calculate the corrected first phase signal versus frequency,

filtering the corrected first phase signal by Hilbert transforming it before filtering it to get a corrected signal to be filtered by detecting a change of a signal with time, being the basis for deriving the property, and

filtering the detected signal by transforming the detected signal to get a Fourier transformed signal, filtering the Fourier transformed signal with a filter to get a filtered Fourier transformed signal, retransforming the filtered Fourier transformed signal to get a filtered signal, and deriving the property on the basis of the filtered signal.

32. (Amended) The method of claim 1, further comprising filtering the corrected first signal before calculating the group delay.

33. (Amended) The method of claim 1, further comprising adapting the filtering to the shape of the corrected first signal by:

making an interferometric signal out of the corrected first phase signal,

Fourier transforming the interferometric signal to get a spectral signal,

determining a fraction of the maximum of the spectral signal,

determining the abscissas of the intersections of the ordinate of the

fraction with the curve of the spectral signal,

determining the mean frequency f_{mean} as the average of the abscissas, and

band-pass filtering the spectral signal with a band-pass filter having its center at the mean frequency and having a width greater than the width of the frequency range.

34. (Amended) The method of claim 1, further comprising determining the ~~width of the band-pass filter by~~:

A2 cont.

predetermining or estimating the maximal range GD_{range} of the group delay,

determining the mean value GD_{mean} of the group delay by determining a fraction of the maximum of the spectral signal, determining the abscissas of the intersections of the ordinate of the fraction with the curve of the spectral signal, and determining the mean frequency f_{mean} as the average of the abscissas, and

calculating the filter width according to the formula: filter width= $f_{mean}(GD_{range}/GD_{mean})$.

35. (Amended) The method of claim 1, further comprising:

subtracting a gradient in the group delay from the group delay,

predetermining the maximum range GD_{range} of the group delay,

determining the mean value GD_{mean} of the group delay by determining a fraction of the maximum of the spectral signal, determining the abscissas of the intersections of the ordinate of the fraction with the curve of the spectral signal, and determining the mean frequency f_{mean} as the average of the abscissas,

calculating the filter width according to the formula: filter width=

$f_{mean}(GD_{range}/GD_{mean})$,

calculating the group delay, and

adding the subtracted gradient to the calculated group delay.

36. (Amended) A software program or product for executing a method for determining a property of an optical device under test, when run on a data processing system, said method comprising:

using a first initial coherent light beam,

changing a first initial property of the first initial light beam,

coupling the first initial light beam to the device under test,

detecting a first signal of the first initial light beam received from the device under test, and

correcting a non-linearity in the first signal caused by a non-linearity in the change of the first initial property by interpolating the first signal on a linear scale.

37. (Amended) An apparatus of determination of properties of an optical device under test, comprising:

a first beam splitter in a path of a coherent light beam for splitting the coherent light beam into a first initial light beam traveling a first initial path and into a second initial light beam traveling a second initial path,

a second beam splitter in that first initial path for splitting the first initial light beam into a first light beam and traveling a first path and into a second light beam traveling a second path,

a place in that first path for coupling the first light beam to the optical device under test,

a third beam splitter in that first and in that second path for

superimposing the first and the second light beam after the second light beam has traveled a different path as the first light beam to produce interference between the first light beam and the second light beam in a resulting first superimposed light beam traveling a first resulting path,

a first power detector for continuously detecting as a first signal the power of the first superimposed light beam as a function of time when tuning the frequency of the coherent light beam from a minimum to a maximum of a given frequency range in a given time interval,

a fourth beam splitter for splitting the second initial beam in a third light beam traveling a third a path and a fourth light beam traveling a fourth path,

A2 cont.

a fifth beam splitter in that third and in that fourth path for superimposing the third light beam and the fourth light beam after each light beam has traveled a different path, to produce interference between the third and the fourth light beam in a resulting second superimposed light beam traveling a second a resulting path,

a second power detector for continuously detecting as a second signal the power of the resulting second superimposed light beam as a function of time when tuning the frequency of the coherent light beam from a maximum to a minimum of a given frequency range in a given time interval, and

an evaluation unit for deriving optical properties of the optical device under test, for using the detected second signal for deriving a non-linearity information about a non-linearity in a tuning gradient of the frequency when tuning the frequency of the coherent light beam from the maximum to minimum of the given frequency range, and for using the non-linearity information for correcting effects on the first signal caused by the non-linearity to get a corrected first signal.

38 The apparatus of claim 37, further having computing means for:

using a first initial coherent light beam,

changing a first initial property of the first initial light beam,

coupling the first initial light beam to the device under test,

detecting a first signal of the first initial light beam received from the device under test,

correcting a non-linearity in the first signal caused by a non-linearity in the change of the first initial property by interpolating the first signal on a linear scale,

and at least one of:

> using a second initial coherent light beam,
>
> changing a second initial property of the second initial light beam,
>
> detecting a second signal of the second initial light beam without coupling it to the device under test, to discover a non-linearity in the second signal caused by a non-linearity in the change of the second initial property, and
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> using the discovered non-linearity of the detected second signal to interpolate the first signal.

39. (Amended) The apparatus of claim 37, further comprising a circulator at that place in that first path to enable the apparatus to examine reflective optical components also.

A3

40. (Amended) The apparatus of claim 37, wherein the second beam splitter, the third beam splitter and the first detector build up a first Mach-Zehnder interferometer, and wherein the fourth beam splitter and the fifth beam splitter and the second detector build up a second Mach-Zehnder interferometer.